REMARKS

The specification has been amended to include the description of knurling and cutting that was included in the originally filed specification, on page 14, lines 8-12, and that was deleted by Amendment (B), filed October 20, 2004. The Abstract of the Disclosure has been amended to comply with MPEP § 608.01(b).

Claim 7 has been cancelled without prejudice. Independent Claim 2 has been amended to incorporate the subject matter of Claim 7. Claim 6 has been amended to depend upon Claim 2. New claims 8-11 have been added.

New claim 8, which depends upon Claim 2, has been added to recite that "the hollow portion formed in the profile portion is located in a periphery of the profile portion" as shown in Figure 6B and 6C of the application as originally filed, and as suggested by the Examiner (See Examiner Interview Summary, mailed December 13, 2004).

New Claim 9 depends upon Claim 2 and additionally recites that "casting the profile portion further comprises the step of: iii. pressurizing hot metal, and injecting and solidifying the hot metal in the cavity of the mold" as supported on page 4, line 26, to page 5, line 1, of the specification as originally filed.

New Claim 10 depends upon Claim 9 and additionally recites that "the mold comprises a plurality of profile portion divided metal molds and a pair of end metal molds surrounding the profile portion so as to allow division of the mold, wherein one of the end metal molds is attached to the helical core; and the method further comprises the step of: pulling out the end metal mold attached to the helical core by rotating the end metal mold attached to the helical core along a helical line" as supported by Figures 3, 4A and 4B, and as described on page 11, lines 4-22, of the application as originally filed.

New independent Claim 11 corresponds to the subject matter recited in independent Claim 2, except that the "left and right helical cross portions" are formed by "knurling" as supported on page 14, lines 8-12, of the specification as originally filed.

The present amendment does not add any new matter to the application.

The Invention

The present invention pertains generally to a method for manufacturing a supercharger rotor. More particularly, in a first embodiment in accordance with the present invention, a method for manufacturing a supercharger rotor by casting a profile portion of a supercharger rotor to surround a shaft penetrating the profile portion is provided that includes the steps recited in Claim 2. In another embodiment in accordance with the present invention, a method for manufacturing a supercharger rotor by casting a profile portion of a supercharger rotor to surround a shaft penetrating the profile portion is provided that includes the steps recited in Claim 11. Various other embodiments of the method are recited in the dependent claims.

All of the method embodiments, in accordance with the present invention, include the step of either "cutting a left and right helical cross portion on a surface of the shaft" or "knurling a left and right helical cross portion on a surface of the shaft" which advantageously provides an improved bonding strength per axial length between the shaft and the profile portion. In fact, this improved bonding strength is at least 38% stronger that what has been conventionally obtained (See Figure 7, and page 15, lines 22-27, of the present disclosure). Furthermore, all of the method embodiments, in accordance with the present invention, include "attaching a helical core inside the cavity of the mold so the profile portion cast includes a hollow portion formed in the profile portion." This step results in the

formation of a supercharger rotor that has a reduced weight, reduced moment of inertia, and enhanced high-speed rotation characteristics (See Specification, page 15, lines 1-6).

The Rejection

Claim 2 stands rejected under 35 U.S.C. § 103(a) as unpatentable over Timuska et al. (U.S. Patent 4,761,124) in view of Miyashita (U.S. Patent 4,224,727). Claims 6 and 7 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Timuska et al. (U.S. Patent 4,761,124) in view of Miyashita (U.S. Patent 4,224,727), and further in view of Gradel (U.S. Patent 5,516,240).

Applicants respectfully traverse the rejection and request reconsideration of the application for the following reasons.

Applicants' Arguments

A patentability analysis under 35 U.S.C. § 103 requires (a) determining the scope and content of the prior art, (b) ascertaining the differences between the prior art and the claimed subject matter, (c) resolving the level of ordinary skill in the pertinent art, and (d) considering secondary considerations that may serve as indicia of nonobviousness or obviousness. Graham v. John Deere Co. of Kansas City, 148 U.S.P.Q. 459, 467 (1966). Furthermore, a proper rejection under Section 103 further requires showing (1) that the prior art would have suggested to a person of ordinary skill in the art that they should make the claimed device or carry out the claimed process, (2) that the prior art would have revealed to a person of ordinary skill in the art that in so making or doing, there would have been a reasonable expectation of success, and (3) both the suggestion and the reasonable expectation of success must be found in the prior art and not in the applicants' disclosure. In re Vaeck, 20 U.S.P.Q.2d 1438, 1442 (Fed. Cir. 1991).

The Timuska Patent

U.S. Patent 4,761,124 to Timuska et al. (hereafter, the Timuska Patent) teaches a "screw-type rotary machine having at least one rotor made of a plastics material," which includes a female rotor (1) and a male rotor (2) as shown in Figure 1. The female rotor (1) has helically extending lands (3) and intermediate grooves (4), and the male rotor (2) has helically extending lands (5) and grooves (6). The female rotor (1) comprises a plastics part (7) moulded on a steel shaft (8) by injection moulding (col. 2, lines 55-58), whereas the male rotor (2) is made of aluminum or steel, or is made of extruded aluminum or plastics (col. 2, lines 59-61).

The Timuska Patent gives little instruction as to how the male rotor (2) is manufactured, and teaches that the female rotor (1) is manufactured by injection moulding (col. 3, lines 22-49). The purpose of injection moulding the female rotor (1) is so that the "surface smoothness is fine enough to make subsequent finishing unnecessary" yet damages caused by a lack of machining are still avoided (See Abstract).

As admitted by the Examiner (Office Action dated July 21, 2004, page 4, lines 20-21), the Timuska Patent does not teach, or even suggest, "cutting a left and right helical cross portion on a surface of the shaft" as recited in claim 2. In fact, the Timuska Patent teaches away from "subsequent finishing" of the female rotor (1) after it has been molded. However, this is not the only deficiency of the teachings of the Timuska patent. The Timuska Patent also does not teach, or even suggest, that casting the profile portion includes (i) "surrounding the cross portion of the shaft with a metal mold so the cross portion is disposed inside a cavity of the mold" and (ii) "attaching a helical core inside the cavity of the mold so the profile portion cast includes a hollow portion formed in the profile portion" as also recited in independent Claims 2 and 11.

The Examiner contends that the shaft (8) having helical edges or lands (10) and concave surfaces (11), as shown in both Figures 1 and 2 of the Timuska Patent, is a "helical core" in accordance with Applicants' invention (Office Action, dated November 29, 2004, page 3, line 9). The Examiner's interpretation is flawed and untenable for two reasons. First, the shaft (8) is not "helical" so it cannot be a "helical core" as recited in Claims 2 and 11 of the present invention. Webster's new collegiate dictionary, 1977, page 531 defines "helical" as "of, relating to, or having the form of a helix." Timuska teaches a straight shaft (8) having helical lands (11) milled therein (col. 3, lines 1-6). Timuska's shaft (8) is not a "helical" shaft.

Second, as shown in Figure 1 of Timuska, the shaft (8) is part of the female rotor (1). Therefore, it is plain that the Timuska Patent does not teach, or even suggest, "attaching a helical core inside the cavity of the mold so the profile portion cast includes a hollow portion formed in the profile portion" as recited in Claims 2 and 11 of the present invention. More specifically, the Timuska Patent does not teach, or even suggest, forming any kind of "hollow portion" in the female rotor (1). This is evident from the cross-sectional view of the female rotor (1), which illustrates no "hollow portion" formed by the shaft (8).

The Timuska Patent also does not teach, or even suggest, "a plurality of cutting tools are used in parallel in lathe work, and multiple thread screws are simultaneously cut" as recited in Claim 6, and "wherein the hollow portion formed in the profile portion is located in a periphery of the profile portion" as recited in Claim 8, and the step of "pressurizing hot metal..." as recited in Claim 9, and the step of "pulling out the end metal mold attached to the helical core by rotating the end metal mold attached to the helical core along a helical line" as recited in Claim 10.

The Miyashita Patent

U.S. Patent 4,224,727 to Miyashita (hereafter, the Miyashita Patent) teaches a "method of making the body of a hydraulic master cylinder," such as would be used in a automobile, motorcycle or other vehicle (col. 1, lines 1-10). As shown in Figure 6, the inner body section (1) of cylinder body (b) of the "assembly of a brake master cylinder" includes ridges (1a) formed as a diamond or double helical knurls on the inner body section by knurling (col. 3, lines 47-49). The Miyashita Patent teaches that the ridges have only a limited heat capacity and are formed to help the inner body section (1) fuse together with the outer body section (2), (col. 3, lines 50-56). The Miyashita Patent does not teach, or even suggest, "cutting a left and right helical cross portion on a surface of the shaft" as recited in claim 2. The Miyashita Patent also does not teach, or even suggest, that "a plurality of cutting tools are used in parallel in lathe work, and multiple thread screws are simultaneously cut" as recited in claim 6.

The Miyashita Patent also does not teach, or even suggest, that casting the profile portion includes (i) "surrounding the cross portion of the shaft with a metal mold so the cross portion is disposed inside a cavity of the mold" and (ii) "attaching a helical core inside the cavity of the mold so the profile portion cast includes a hollow portion formed in the profile portion" as also recited in independent Claims 2 and 11. In addition, the Miyashita Patent also does not teach, or even suggest, "wherein the hollow portion formed in the profile portion is located in a periphery of the profile portion" as recited in Claim 8, and the step of "pressurizing hot metal..." as recited in Claim 9, and the step of "pulling out the end metal mold attached to the helical core by rotating the end metal mold attached to the helical core along a helical line" as recited in Claim 10.

The Gradel Patent

U.S. Patent 5,516,240 to Gradel (hereafter, the Gradel Patent) teaches a "device for milling" that includes a turning tool (3) having a cutting edge (4) made up of a plurality of cutting edge portions adapted to be individually engaged with a workpiece (1), (See Abstract, and Figure 4). The Gradel Patent teaches that the cutting edges (4) independently cut the workpiece (1) in succession (See Abstract, and col. 3, lines 26-35); therefore, the Gradel Patent cannot teach, or even suggest, that "multiple thread screws are simultaneously cut" as recited in Claim 6.

However, this is not the only deficiency in the teachings of the Gradel Patent. The Gradel Patent also does not teach, or even suggest, that casting the profile portion includes (i) "surrounding the cross portion of the shaft with a metal mold so the cross portion is disposed inside a cavity of the mold" and (ii) "attaching a helical core inside the cavity of the mold so the profile portion cast includes a hollow portion formed in the profile portion" as recited in independent Claims 2 and 11. In addition, the Gradel Patent does not teach, or even suggest, "wherein the hollow portion formed in the profile portion is located in a periphery of the profile portion" as recited in Claim 8, and the step of "pressurizing hot metal..." as recited in Claim 9, and the step of "pulling out the end metal mold attached to the helical core by rotating the end metal mold attached to the helical core along a helical line" as recited in Claim 10.

In view of the teachings of the Timuska Patent, the Miyashita Patent, and the Gradel Patent, the Examiner's Section 103 rejections are untenable and must be withdrawn for multiple reasons. First, neither the Timuska Patent, the Miyashita Patent, nor the Gradel Patent teach, or even suggest, that casting the profile portion includes (i) "surrounding the cross portion of the shaft with a metal mold so the cross portion is disposed inside a cavity of the mold" and (ii) "attaching a helical core inside the cavity of the mold so the profile portion

cast includes a hollow portion formed in the profile portion" as also recited in independent Claims 2 and 11. In addition, neither the Timuska Patent, the Miyashita Patent, nor the Gradel Patent teach, or even suggest, "wherein the hollow portion formed in the profile portion is located in a periphery of the profile portion" as recited in Claim 8, and the step of "pressurizing hot metal..." as recited in Claim 9, and the step of "pulling out the end metal mold attached to the helical core by rotating the end metal mold attached to the helical core along a helical line" as recited in Claim 10.

Lastly, the Gradel Patent teaches multiple cutting edges that are applied in succession to cut a helical threads but it does not teach, or even suggest, the subject matter of Claim 6, which recites "a plurality of cutting tools are used in parallel...and multiple thread screws are simultaneously cut."

Conclusion

The Examiner's rejection of Claim 2 under 35 U.S.C. § 103(a) is untenable and must be withdrawn because the scope of the combined teachings of the Timuska Patent, the Miyashita Patent, and the Gradel Patent does not teach, or even suggest, that casting the profile portion includes (i) "surrounding the cross portion of the shaft with a metal mold so the cross portion is disposed inside a cavity of the mold" and (ii) "attaching a helical core inside the cavity of the mold so the profile portion cast includes a hollow portion formed in the profile portion" as recited in independent Claims 2 and 11. In addition, neither the Timuska Patent, the Miyashita Patent, nor the Gradel Patent teach, or even suggest, "wherein the hollow portion formed in the profile portion is located in a periphery of the profile portion" as recited in Claim 8, and the step of "pressurizing hot metal..." as recited in Claim 9, and the step of "pulling out the end metal mold attached to the helical core by rotating the end metal mold attached to the helical core along a helical line" as recited in Claim 10.

Lastly, the Examiner has misconstrued the teachings of the Gradel Patent, which is limited to teaching multiple cutting edges applied successively to cut threads. Consequently, the Examiner has failed to establish a prima facie case of obviousness against the subject matter of Claim 6, which requires "multiple thread screws are simultaneously cut."

For all of the above reasons, claims 2, 6 and 8-11 are believed to be in condition for allowance, and a prompt notice of allowance is earnestly solicited.

Questions are welcomed by the below-signed attorney for Applicants.

Respectfully submitted,

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